FACING CATARACT SURGERY IN GLAUCOMA PATIENTS

Patsoura Elisabeth, Metaxaki Ioanna and Georgaras Spyros

Ophthalmos Research and Therapeutic Institute, Athens, Greece

The coexistence of cataract and glaucoma is a frequent condition especially in the elderly population. Planning cataract surgery in glaucoma patients can be very challenging. Due to development of new techniques the surgeon has more choices of methods than in the past including non-penetrating and minimally invasive procedures. The final decision on whether to perform combined cataract - glaucoma surgery depends on patients’ characteristics and has to be customised. This review focuses on the multiple aspects of preoperative assessment of these patients, including ocular and systemic pathology, pearls on overcoming intraoperative difficulties and securing the best possible surgical outcome and finally, recommendations on intraocular lens choice. Premium lens can be considered, providing specific criteria are fulfilled. The new frontiers of glaucoma surgery are also discussed.

Facing cataract surgery in glaucomatous patients

Despite the emergence of multiple medical and surgical therapies, glaucoma is one of the leading causes of blindness worldwide (1) with a high percentage of sufferers being undiagnosed. Several studies have shown that the incidence of cataract in glaucoma patients increases with age (2,3). The management of combined existence of glaucoma and cataract can be very challenging. As there are several options and a variety of procedures, the decision on the type of surgery to be performed has to be based on various considerations and needs to be customized for each patient.

Categories of glaucoma patients that need cataract surgery

a) Asymptomatic: those are patients with no previous diagnosis of glaucoma but with predisposing conditions such as pseudoexfoliation, positive family history of glaucoma, narrow angles.

b) Controlled glaucoma patients: adequate control is determined by both structural (e.g. optic disc assessment by stereofundus pictures, scanning laser ophthalmoscopy, GRx) and functional tests (automated perimetry) that demonstrate no progression, as well as intraocular pressure (IOP) measurements within the desired range of target pressure. Control of IOP could be accomplished through medical treatment, laser (Argon, YAG trabecuoplasty, Excimer Laser Trabeculostomies - ELT) or pneumatic (PNT) trabecuoplasty, laser iridotomy or surgical procedures (trabeculectomy, valve insertion etc.)

c) Uncontrolled glaucoma patients: those are patients who have not received any treatment (newly diagnosed) or with previous treatment failure.

d) Special glaucoma cases: eyes with congenital glaucoma (with or without concomitant defects such as iris coloboma, aniridia),
inflammatory glaucoma, traumatic glaucoma, planned triple operations (such as keratoplasty, keratoprothesis etc.), post-vitrectomized eyes etc.

**Should cataract and glaucoma procedures be combined?**

Before deciding on whether to combine cataract and glaucoma surgery or not, the surgeon has to consider factors displayed in Table (1).

**Table 1. Factors affecting decision for combined glaucoma-cataract surgery**

<table>
<thead>
<tr>
<th>Factors affecting decision for combined glaucoma-cataract surgery</th>
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<tbody>
<tr>
<td>1. Patient’s age and general health</td>
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<td>2. Optic nerve function, intraocular pressure control</td>
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<td>3. Self maintenance</td>
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<td>4. Patient’s quality of life</td>
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<tr>
<td>5. Compliance with medical treatment</td>
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<tr>
<td>6. Ocular and systemic comorbidity (ocular surface disease, retina pathology, anticoagulant therapy etc)</td>
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For example, one would be inclined to perform a combined procedure to a young patient with moderate glaucoma and poor compliance to medical treatment, but not to a very elderly patient with multiple systemic problems that carry a significant risk for suprachoroidal hemorrhage (4).

The decision of combined surgery has to be weighed against phacoemulsification alone. The latter causes a postoperative IOL reduction of 1.5mmHg that is sustained for 3 to 5 years post-surgery (5). The amount of IOP reduction depends on pre-operative IOP (6). Especially in chronic angle closure glaucoma, phacotrabeculectomy with adjunctive mitomycin C has only demonstrated a marginally better IOP control and more complications compared to phacoemulsification alone (7).

**Combined cataract-glaucoma procedures**

When the decision for combined surgery is taken, the next step is choosing the appropriate procedure. In controlled cases where discontinuation of medical therapy is desirable due to difficulty in compliance, ocular surface irritation or systemic side effects, minimally invasive procedures (MIGS) or other glaucoma surgery can be planned. Patients with poor control could also undergo MIGS, penetrating glaucoma surgery or valve insertion. For special cases trabeculectomy or valve insertion is the preferred approach.

The European Glaucoma Society (8) recommended combined surgery in open angle glaucoma eyes with cataract in the following groups (Figure 1).

![Figure 1](image-url)

*Figure 1. reproduced from the European Glaucoma Society. Terminology and guidelines for glaucoma*
1) Eyes with moderate or early glaucoma with IOP above or at target with multiple medications,
2) Eyes with severe glaucoma and IOP at target with monotherapy.

Trabeculectomy remains the gold standard for glaucoma surgery. With the advent and development of minimally invasive glaucoma techniques (Table 2), the indications for combined cataract-glaucoma procedures have expanded. MIGS are gaining acceptance among cataract surgeons, as they can easily be combined with cataract surgery, have a short learning curve and come with fewer complications compared to traditional trabeculectomy. In addition the ab interno techniques spare the conjunctiva in case that penetrating glaucoma surgery is needed in the future. Among the disadvantages of MIGS are the additional cost, the inferior efficacy compared to trabeculectomy, limited long term experience and availability (9).

Table 2: Types of Minimally invasive glaucoma procedures (MIGS)

<table>
<thead>
<tr>
<th>Ab interno</th>
<th>Ab externo</th>
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</thead>
<tbody>
<tr>
<td>I-stent</td>
<td>Express mini shunt</td>
</tr>
<tr>
<td>Hydrus</td>
<td>Canaloplasty with i-science</td>
</tr>
<tr>
<td>Cypass</td>
<td></td>
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<tr>
<td>ELT(excimer laser trabeculopasty)</td>
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<tr>
<td>Trabectome</td>
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<tr>
<td>Endocycloablation</td>
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<td>Aquesys implant</td>
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How to plan cataract surgery and choose the optimal intraocular lens design and power

There are several considerations when planning cataract surgery in glaucoma patients. Preassessment includes determination of patient’s visual needs, ocular dominance, especially if monovision is aimed for, visual acuity and status of the fellow eye. Clinical-preassessment of the eye to be operated includes careful examination of the 1) eyelids for meibomian gland dysfunction and other eyelid defects 2) cornea for presence of epithelial, endothelial and tear film abnormalities 3) anterior chamber depth 4) iris and pupil abnormalities, such as poor miosis, anatomical defects and pseudoxfoliation. 5) Stability of the Zinn zone and integrity of the lens capsule 6) optic nerve function, macula and vitreous pathology. More specialized measurements include the size of the optical zone, pupil size under different light conditions, ocular wavefront (for spherical aberrations), and evaluation of anterior and posterior cornea surface for astigmatism.

IOL selection can also be influenced by patient’s general health and strong family history of ocular disease.

Technical approach of cataract surgery in glaucoma patients

Glaucoma patients especially those with pseudoexfoliation syndrome (10) and those with previous IOP lowering surgery, present with various degrees of compromised endothelium. Endothelial cell loss increases with time (11,12) therefore extra caution should be taken to protect endothelial cell during phacoemulsification. Right choice of viscoelastics and soft shell technique is indicated (13). Viscoelastics can also assist pupil mydriasis and maintenance of anterior chamber depth. Visibility can be troublesome during surgery as ocular surface disease is almost always present in medically treated glaucoma eyes (14). Poor mydriasis and progressive weakening of the Zinn zone is a hallmark of pseudoexfoliation syndrome (15). For pupil dilation use of iris hooks or Malyugin ring may be necessary. Iris hooks or capsular bag retractors can be used for stabilization of the capsular bag during phacoemulsification (Leni’s technique, figure 2). In addition capsular tension rings can be inserted and if needed can be sutured to anchor the aphakic system (bag+IOL) to the iris. Torsional phacoemulsification reduces vibrations and shock waves and has an advantage over longitudinal ultrasound. Parameters of phacoemulsification depend on the stability of Zinn zone. Collapsing of the anterior chamber should be avoided by using viscoelastic substances prior to removal of instruments. Various studies have compared the IOP lowering effect of one versus two site combined phacoetrabeculectomy surgery with no clear advantage of one over the other (16,17). Nevertheless, a two separate site approach is preferable as this technique does not affect the integrity of the cataract wound especially if a premium IOL is to be used. Use of mitomycin-C enhances the long term IOP lowering effect of combined surgery (16). If trabeculectomy has proceeded cataract surgery, then the site of the latter has to be away from the bleb. A recent study from Hussain et al (18) showed that the function of trabeculectomy was adversely affected from cataract surgery and the risk for failure was greater the shorter the interval between the two procedures, the greater the risk for failure.
Figure 2. Leni’s technique for capsular support using iris hooks

Intraocular lens power and design choice

Calculation of the intraocular lens power merits special attention. Sudden reduction of the intraocular pressure following combined surgery causes subsequent reduction in axial length, especially in young myopic eyes (19). That could result in hyperopic refractive surprises, unless an IOL of higher power is chosen. Keratometry readings change with trabeculectomy producing with the rule astigmatism of about a diopter depending on the surgical procedure. That can potentially affect the choice of the astigmatic correction during cataract surgery.

In glaucoma patients contrast sensitivity is defective compared to normal individuals (20) therefore an IOL that enhances contrast is preferred (21). Aspheric IOLs compensate for the positive spherical aberrations of the cornea so is the IOL of choice providing good centration of the IOL is achieved.

Toric IOLs can be used in cases with corneal astigmatism over one diopter. They are not recommended for eyes with laxity or other defects of the Zinn zone. Presbyopia correcting IOLs depend on good centration as well, and their use in glaucoma eyes is limited. Multifocal IOLs reduce contrast sensitivity (22). Those lenses can compromise further visual function in eyes with moderate or advanced glaucoma changes. Visual field assessment and follow up can also be difficult in eyes implanted with this type of lenses. The literature lack studies on multifocal IOLs in glaucoma patients so decision whether to be implanted or not has to be individualized (23).

Recommendations for use of premium lenses in glaucoma patients are given in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>Ocular hypertension</th>
<th>Mild glaucoma</th>
<th>Moderate glaucoma</th>
<th>Severe glaucoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspheric IOL</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Toric IOL</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Multifocal IOL</td>
<td>+/-</td>
<td>+/-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Accommodative IOL</td>
<td>+/-</td>
<td>+/-</td>
<td>-</td>
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</table>

Table 3: Premium IOL use in glaucoma patients

New frontiers in glaucoma surgery

There is increased experimental interest in the applications of femtosecond laser in glaucoma surgery. Femtosecond laser has been tried for creation of scleral flaps (24), scleral channels (25) and for photodisruption of trabecular meshwork (26). Further studies are needed to establish the parameters of the laser to be used and assess the long term effect on tissue healing response. It is still unclear to what extent this technology can be incorporated to our armamentarium for glaucoma surgery.

Conclusion

Cataract surgery in glaucoma patients can be rather challenging. With a growing number of minimally invasive glaucoma procedures the surgeon has many options. The decision on proceeding with single or combined surgery has to be individualized. Meticulous preoperative planning safeguards the best possible outcome for the patient. Intraoperatively special characteristics of glaucoma eyes may require modification of the surgeon’s routine cataract technique in order to avoid complications. With careful case selection these patients can be offered a premium IOL, providing the relative criteria are fulfilled.
IZAZOVI OPERACIJE KATARAKTE KOD GLUKOMATOZNIH PACIJENATA

Patsoura Elisabeth, Metaxaki Ioanna i Georgaras Spyros

Ophthalmos Research and Therapeutic Institute, Athens, Greece


Ključne reči: operacija katarakte, glaukom, kombinovana

Corresponding: Spyros Georgaras
Ophthalmos Research and Therapeutic Institute, Athens, Greece
13 A Metaxa str, Glyfada, Athens, Greece
E-mail: ophthalmos@ophthalmos.gr